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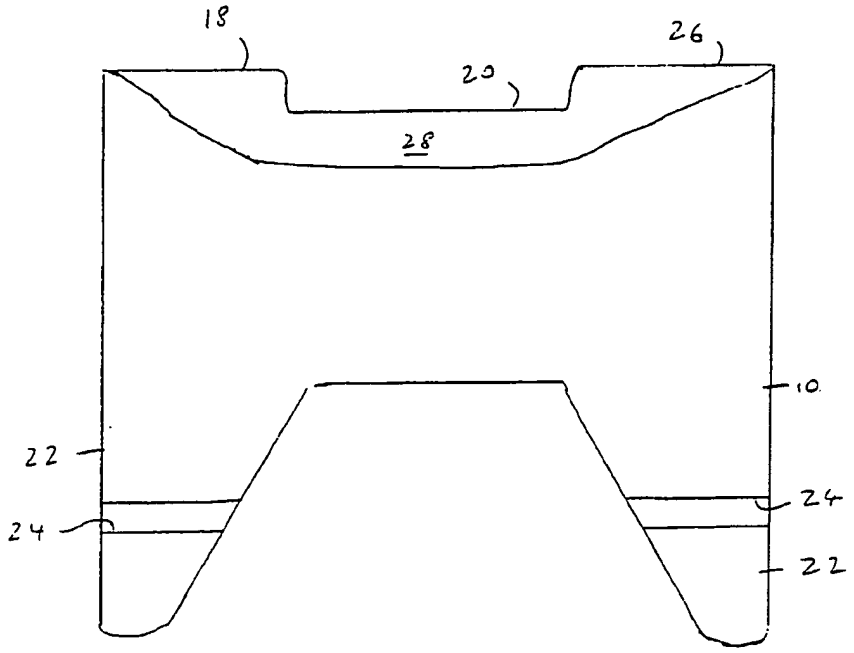
(54) Title: A PISTON HEAD AND TO A METHOD OF MAKING A PISTON HEAD



(57) Abstract: The invention provides a piston head (10) having a bowl (20) in the crown (18) thereof. At least the upper edge of the bowl (20), and preferably the whole crown (18) is made of a material resistant to thermal oxidation, such as stainless steel. The remainder of the piston head (10) is made of conventional hot forging material.

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A piston head and to a method of making a piston head

The invention relates to a piston head and to a method of making a piston head.

It is known to shape the surface of a piston head which faces the combustion chamber, i.e. the crown surface, with a central recess or "bowl". Due to the increasingly high compression pressures and temperatures used in modern diesel internal combustion engines, there is a tendency for the bowl in the crown of the piston head to undergo degradation by thermal oxidation and consequently to crack around the sides of the bowl and particularly around the entrance to the bowl over time. Materials are known which would provide better resistance to thermal oxidation and the resulting cracking, for example, stainless steel, but cannot be forged as easily as conventional material and are more expensive.

According to the invention there is provided a piston head having a bowl in the crown thereof, at least the upper edge of the bowl being made of a material resistant to thermal oxidation and another part of the piston head being made of a different material.

In this way, the bowl is protected from thermal oxidation because of the use of a suitably resistant material, but another part of the piston head is made of a different material and can be made of conventional hot forging material so that the piston head can be forged in the usual way without the difficulty and expense involved in moving to a construction where the piston head is made entirely of thermal oxidation resistant material.

Preferably, at least the lead-in to the bowl and the walls of the bowl are made of the thermal oxidation resistant material. In a preferred embodiment, the whole of the crown is made of the thermal resistant material. The thermal resistant material may be any suitable material and may be, for example, stainless steel. In one embodiment, the said other part of the piston head constitutes the remainder of the piston head.

According to another aspect of the invention there is provided a method of making a piston head having a bowl in the crown, the method comprising hot forging a billet comprising one part made of thermal oxidation resistant material and another part made of a material for hot forging, such that the forged piston head has a bowl in the crown and at least the upper edge of the bowl is made of the thermal oxidation resistant material.

The two said parts of the billet are preferably fixed together prior to hot forging. The two said parts of the billet may be fixed together in any suitable way and may be welded together for example by flash butt welding, or may be diffusion bonded together, but preferably the two said parts are friction welded together. This method is simple and inexpensive but provides a very strong connection.

According to a further aspect of the invention there is provided a piston head hot forged from a billet comprising one part made of a thermal oxidation resistant material and another part made from a material for hot forging, the piston head having a bowl in the crown and at least the upper edge of the bowl being made from the thermal oxidation resistant material.

Clearly the method is of wider application and could be used in numerous circumstances where it is desired to use the hot forging technique, but where part of the article would benefit from fabrication in a material other than a conventional hot forging material.

According to another aspect of the invention there is provided a method of making an article, the method comprising hot forging a billet comprising one part made of a material for hot forging and another part made from a different material.

According to a further aspect of the invention there is provided an article hot forged from a billet comprising one part made of a material suitable for hot forging and another part made of a different material.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

Fig 1 is a perspective view of the piston head of the embodiment;

Fig 2 is a cross section of the piston head of the embodiment at A-A of Fig 1; and,

Fig 3 is a perspective view of the billet to be hot forged into the piston head of the embodiment.

In order to make the piston head 10 of the embodiment a cylindrical billet 12, as shown in Figure 3, is prepared by friction welding together two cylindrical parts 14,16 of common diameter. The top part 14 of the resulting billet 12 is made of stainless steel and the lower part 16 of the billet 12 is made of a conventional hot forging material for making piston heads, in this case the steel SE 4140. The top part 14 may be about 40% of the total height of the billet 12.

The billet 12 is hot forged in conventional fashion and the resulting piston head 10 is shown in Figures 2 and 3. The piston head 10 is of known shape and consists of a crown 18 in which a bowl 20 is defined coaxially therewith. The piston head 10 has two ears 22 depending therefrom at opposite sides of the piston head 10. The ears 22 define apertures 24, the axes of which are collinear, the apertures 24 in the ears 22 being arranged to receive a gudgeon pin (not shown) to mount a connecting rod (not shown) of a diesel internal combustion engine in conventional fashion.

As seen in Figure 2, the distribution of the stainless steel after hot forging is such that it makes up the entirety of the top surface 26 of the crown 18 of the piston head 10 including the whole of the bowl 20. Indeed, the stainless steel layer 28 in the piston head 10 has a reasonably uniform depth or thickness around the bowl 20, the thickness of the stainless steel layer 28 then decreasing steadily towards the edges of the top surface 26 of the crown 18.

In this way, the piston head 10 will be much less prone to cracking due to the high compression ratios of modern diesel engines and the subsequent pressure to which it

will be subjected in use because the area with the greatest risk of cracks appearing, namely around the bowl 20 and in the walls of the bowl 20, is made of stainless steel, which has a much greater resistance to thermal oxidation than conventional hot forging material for piston heads. The ears 22 however, which would be difficult to hot forge in stainless steel, are still made in the conventional material and so the pressure under which the billet 12 is hot forged does not need to be increased in spite of the presence of the stainless steel, so that no additional energy is required to result in this more robust construction.

Claims

1. A piston head having a bowl in the crown thereof, at least the upper edge of the bowl being made of a material resistant to thermal oxidation and another part of the piston head being made of a different material.

2. A piston head as claimed in claim 1, wherein the said other part of the piston head is made of conventional hot forging material .

3. A piston head as claimed in claim 1 or claim 2, wherein at least the lead-in to the bowl is made of thermal oxidation resistant material.

4. A piston head as claimed in claim 1, 2 or 3, wherein at least the walls of the bowl are made of thermal oxidation resistant material.

5. A piston head as claimed in claim 4, wherein the floor of the bowl is made of the thermal oxidation resistant material.

6. A piston head as claimed in any preceding claim, wherein the whole of the crown is made of thermal oxidation resistant material.

7. A piston head as claimed in any preceding claim, wherein the thermal oxidation resistant material is stainless steel.

8. A method of making a piston head having a bowl in the crown, the method comprising hot forging a billet comprising one part made of thermal oxidation resistant material and another part made of a material for hot forging, such that the forged piston head has a bowl in the crown and at least the upper edge of the bowl is made of the thermal oxidation resistant material.

9. A method as claimed in claim 8, wherein the two said parts of the billet are fixed together prior to hot forging.

10. A method as claimed in claim 9, wherein the two said parts are friction welded together.

11. A piston head hot forged from a billet comprising one part made of a thermal oxidation resistant material and another part made from a material for hot forging, the piston head having a bowl in the crown and at least the upper edge of the bowl being made from the thermal oxidation resistant material.

12. A method of making an article, the method comprising hot forging a billet comprising one part made of a material for hot forging and another part made from a different material.

13. A method as claimed in claim 12, wherein the two said parts are fixed together prior to hot forging.

14. A method as claimed in claim 13, wherein the two said parts are friction welded together.

15. An article hot forged from a billet comprising one part made of a material suitable for hot forging and another part made of a different material.

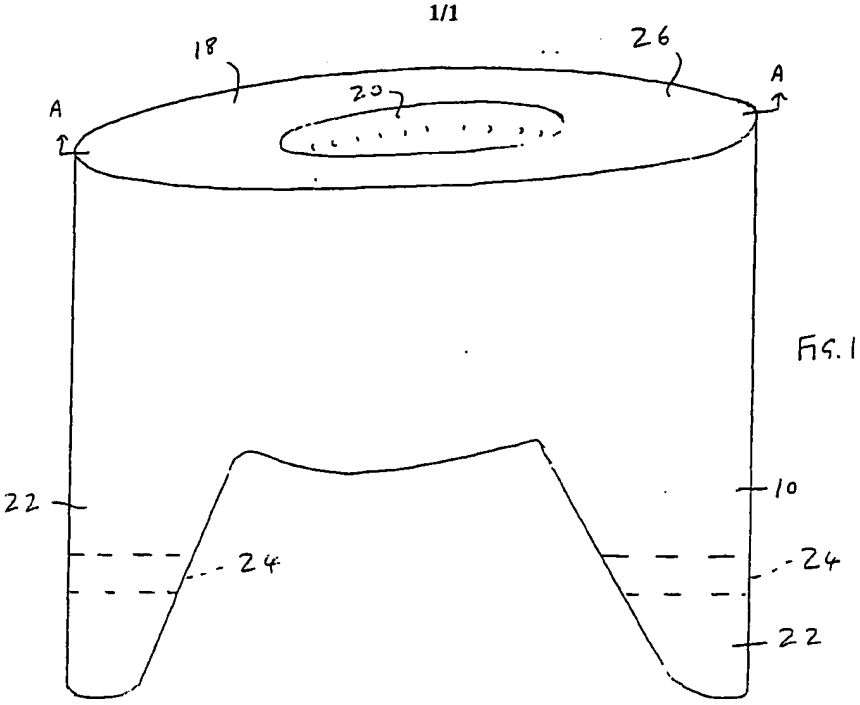

Fig. 1

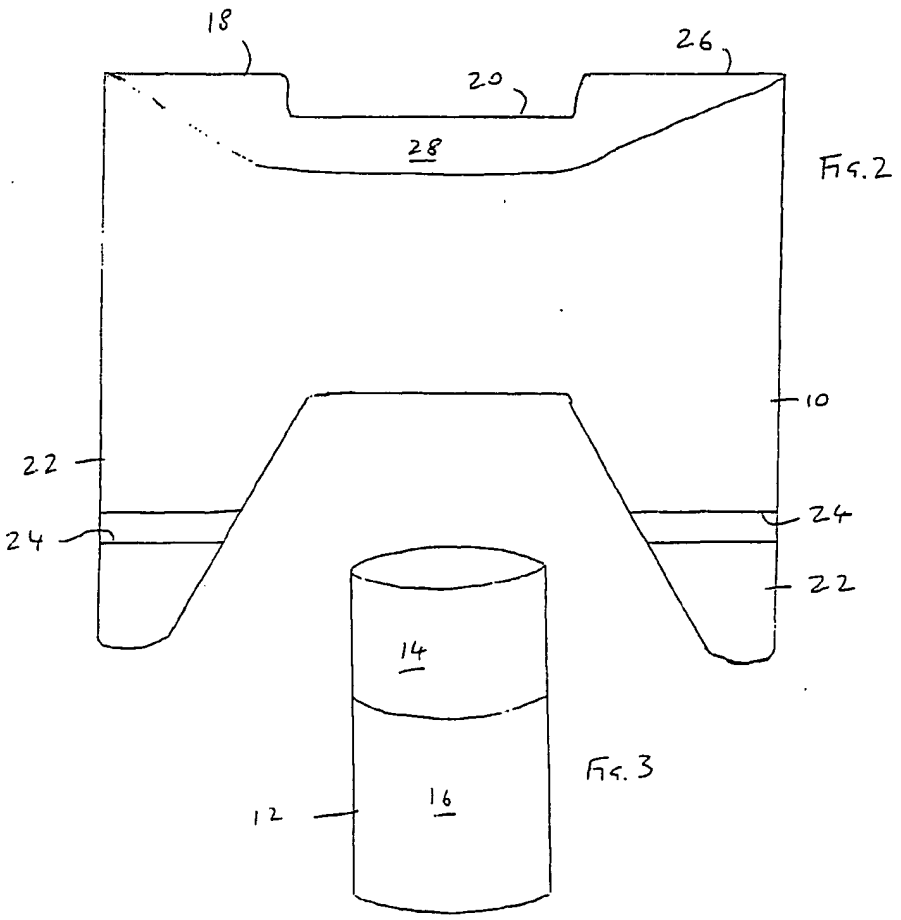

Fig. 2

Fig. 3

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F02F3/00 B23P15/00 B21K1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

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A	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 08, 30 June 1998 (1998-06-30) & JP 10 082345 A (YAMAHA MOTOR CO LTD), 31 March 1998 (1998-03-31) abstract --- -/--	1,9, 11-13,15

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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